July 31, 1956

C. R. HOYT

TRANSFER METHOD OF APPLYING COLOR LINES TO TELEVISION TUBE SCREEN

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2,757,112

Fig. 1.

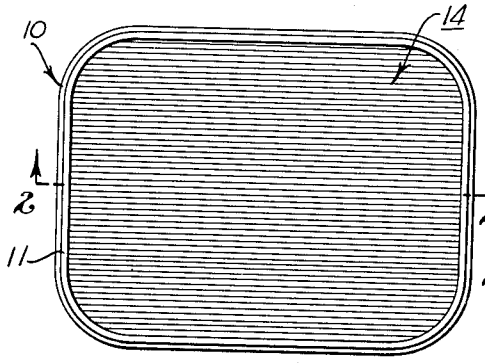


Fig. 3.

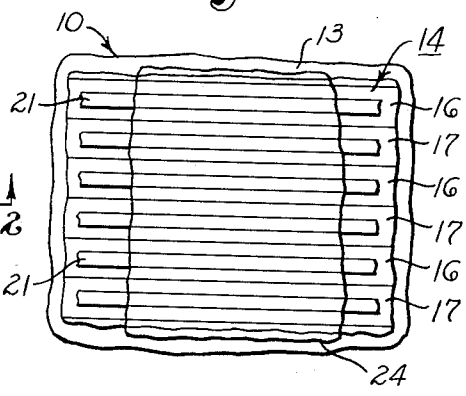


Fig. 4.

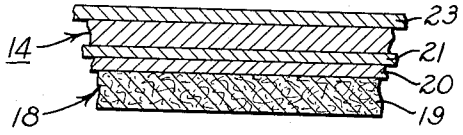


Fig. 5.

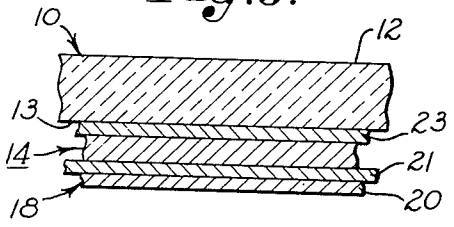


Fig. 6.

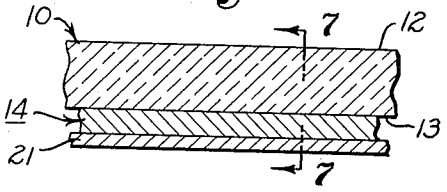


Fig. 7.

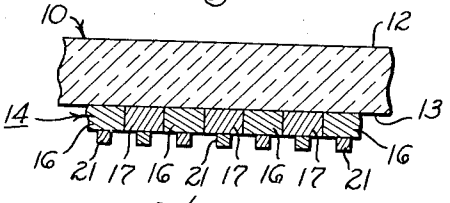


Fig. 8.

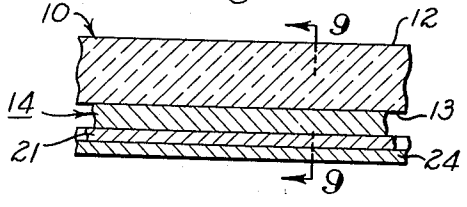


Fig. 9.

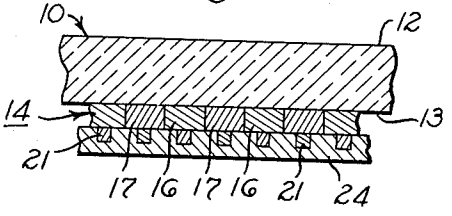
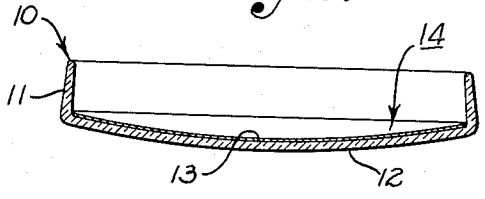


Fig. 2.



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TRANSFER METHOD OF APPLYING COLOR LINES TO TELEVISION TUBE SCREEN

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13 Claims. (Cl. 154—99)

This invention relates primarily to a color television screen and a method of making the same.

It is conventional practice in the art to make a large cathode ray tube for television use by employing a metal or glass cone of either circular or rectangular cross section, together with a glass face plate of matching shape, the face plate being secured to the cone by welding or otherwise at relatively high temperatures. Such face plates are commonly provided with a peripheral flange which fits into the cone and by which the cone is secured to the face plate by welding at high temperature. Also, the face plate is commonly convex outwardly, providing an inner face which is concave.

It has been suggested in the art that a cathode ray tube capable of reproducing a picture in color may be made by providing on the inner face of the face plate a grid of substantially parallel lines or stripes of alternating translucent colors, such as alternating red and blue-green stripes for a two-color picture, and alternating red, blue, and green stripes for a three-color picture, the stripes, of course, to be covered by a photoluminescent material, such as a phosphor, which can be activated by an electron scanning beam in the tube. One material suggested for the stripes is a translucent medium carrying a dye of a desired color or colors.

Various difficulties have been encountered, however, in attempts to manufacture such a color television tube. First, the upstanding flange on the face plate seriously hinders the application of such colored stripes by painting, screening, or other conventional application methods on the inner face of the face plate. Secondly, it is difficult, if not impossible, to apply the stripes to the concave inner face of the face plate so that such stripes are substantially parallel, which is essential to permit accurate scanning, as it is extremely difficult to paint or apply substantially parallel stripes to a concave surface. Thirdly, materials hitherto used for the colored stripes have contained undesirable volatiles which volatilize when the face plate is welded to the cone of the tube by the application of the high temperatures required, often in excess of 950° F., and such volatiles tend to contaminate the interior of the tube. Applying the stripes to the inner surface of the face plate after the latter is welded to the cone is, of course, impossible.

A primary object of this invention is to provide such a color television tube in which a grid of translucent, colored, substantially parallel stripes is applied to the inner face of the face plate of the tube, and I prefer to accomplish this by utilizing a decalcomania embodying the colored stripes, by which means the stripes may be readily applied to the face plate in their desired position and in parallelism regardless of the curvature of the face plate. Such decalcomania may be formed in conventional fashion generally well known in the art, but the grid is formed by printing or screening the colored stripes on the backing of the decalcomania in perfect parallelism. Since the backing is flat when the stripes are applied thereto, the stripes may readily be applied in parallelism.

A further object of the invention is to provide a method of making such a color television tube, in which, after such decalcomania has been applied to the inner surface of the face plate so as to affix the colored stripes thereto, the face plate is baked or otherwise heated to a temperature slightly in excess of any temperature subsequently applied to the face plate in the manufacture of the complete tube, so as to volatilize and dissipate substantially all volatilizable materials in the decalcomania before assembly of the tube to prevent contamination of the interior of the tube thereby in the subsequent completion of its manufacture.

Another object of the invention is to provide such a decalcomania in which the colored stripes are formed of a material which will adhere to glass when subjected to adequate temperatures, such as ground colored optical glass in a binder, so that during the heating of the face plate, as above described, the translucent colored material forming the stripes will be adhered to the surface of the glass face plate and thereby rigidly secured thereto.

A further object of the invention is to provide such a decalcomania in which thin wires of electroconductive material, such as platinum, for example, are applied in the process of manufacture of the decalcomania between the colored stripes and the backing sheet thereof, the wires being disposed on at least some of the stripes and parallel thereto, each of the wires having a width substantially less than the width of the colored stripe with which it is in registry. Still another object of the invention is to employ such a decalcomania including such wires to provide a grid upon the inner surface of the face plate of a tube, as generally described above, and in which the wires are superimposed on the stripes in the completed face plate. A further object is to cover the grid of colored stripes with the wires thereon with a photoluminescent material, such as a phosphor so that the latter covers and is in contact with the stripes and the wires.

Other objects and advantages of the invention will be apparent from the following specification and the drawing, which are for the purpose of illustration only, and in which:

Fig. 1 is a plan view of the inner surface of a face plate of a television cathode ray tube, incorporating the present invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged fragmentary view of a portion of Fig. 1;

Fig. 4 is an enlarged fragmentary cross-sectional view of a portion of the decalcomania of the invention;

Fig. 5 is a view similar to Fig. 4, showing the decalcomania applied to the face plate and with the backing sheet removed;

Fig. 6 is a view similar to Fig. 5 but after heating of the face plate;

Fig. 7 is a cross-sectional view taken on the line 7—7 of Fig. 6;

Fig. 8 is a view similar to Fig. 6 but showing a layer of phosphor upon the grid; and

Fig. 9 is a cross-sectional view on the line 9—9 of Fig. 8.

Referring to the drawing, Figs. 1 and 2 show a glass face plate 10, of conventional shape, having an upstanding peripheral flange 11 and providing an outer convex surface 12 and an inner concave surface 13. Formed on the inner surface 13 is a grid 14 of translucent, colored and substantially parallel stripes. As better shown in Fig. 3, the grid is composed of a first set of stripes 16, and a second set of stripes 17, the stripes of the two sets alternating. The two sets of stripes 16 and 17 are of different colors, and, for illustration, the stripes of the set 16 may be of a translucent red material and those

of the set 17 of a translucent blue-green material, where the face plate is to be used in the construction of a two-color television tube. It will be understood, of course, that any desired number of sets of stripes of different colors may be employed without departing from the spirit of the invention. Thus, three sets of alternating blue, green, and red stripes would be employed to form the face plate for a three-color television tube.

The grid 14 is formed from a decalcomania 18, a fragment thereof being shown in Fig. 4. The decalcomania 18 includes a first layer of conventional paper backing 19, upon which is superimposed a layer of tacky adhesive 20. Upon the adhesive layer 20, are positioned parallel wires 21 of electroconductive material, such as, for example, platinum wire. If desired, to facilitate manufacture, the wires may be formed of a powdered electroconductive material in a binder which is printed on the decalcomania, such material, such as powdered silver, being conventionally employed in the printing of radio circuits as is well known in the art. It is also to be noted that while I prefer to include the wires 21, for specific control circuits for the finished tube, and while the inclusion thereof is one feature of the invention, still the wires may be omitted if desired.

In the decalcomania 18, superimposed on the wires 21 is the grid 14 consisting of the sets of stripes 16 and 17. The stripes may be formed by printing, screening, or otherwise applying the translucent materials of which they are formed to the decalcomania. Such material may be a colored dye in a suitable liquid vehicle, or may be formed of finely ground colored glass carried by the vehicle, the vehicle, of course, drying substantially in the making of the decalcomania. By printing or screening the stripes 16 and 17 on the decalcomania while retaining the same flat, the stripes may be provided in parallelism. Finally, a further layer 23 of clear binder is provided on the grid 14, and the decalcomania is complete and ready for application to the face plate 10. Such finished decalcomanias may be conveniently stored or shipped for use, and need not be made at the same place where the face plates 10 are made or assembled into a final tube assembly, and this is a further advantage of the invention.

The decalcomania 18 is applied to the inner surface 13 of the face plate 10 in conventional manner, with the stripes 16 and 17 generally parallel with the sides of the face plate if the latter is rectangular in shape. If the face plate 10 is circular in shape, the orientation of the decalcomania is usually of no importance. As the decalcomania 18 is applied to the face plate 10, the backing sheet 19 is removed therefrom in the conventional manner to leave the balance of the decalcomania temporarily affixed to the inner surface 13 of the face plate, as illustrated in Fig. 5.

The face plate 10, with decalcomania attached, is then baked or otherwise heated so as to expose the decalcomania to a sufficiently high temperature to vaporize and drive off substantially all volatiles from the decalcomania and to affix more permanently the stripes 16 and 17 to the inner surface 13 of the face plate. This step is very important where the face plate 10 is to be joined to a tube cone by conventional welding methods. Such welding is commonly carried on at temperatures such that the inner surface 13 of the face plate 10 rises to a temperature of about 950° F., or even higher. In my method, the face plate is baked or heated at a temperature in excess of any subsequently used in the welding step. For example, if the welding step would normally bring the inner surface 13 to a temperature of 950° F., in my baking step the face plate is exposed to a temperature of about 1025° F., which is sufficiently high to volatilize substantially all of the volatile substances in the decalcomania 18. This prevents subsequent contamination of the interior of the finished television tube, as volatiles that would otherwise be driven off into the tube during the welding step are eliminated theretofore by my method. Such heating also adheres the solid material of the stripes 16 and 17 to the inner surface 13 of the face plate 10, particularly if the stripe material includes ground glass. After such baking or heating step the assembly appears substantially as shown in Figs. 6 and 7 in which the grid 14 is secured directly to the inner surface 13 of the face plate 10 and in turn carries and holds the wires 21, the layers 20 and 23 being volatilized and eliminated in the testing step.

Finally, as shown in Figs. 8 and 9, a continuous layer 24 of a photoluminescent material, such as a phosphor, is applied by any conventional method over the wires 21 and grid 14, such layer directly covering and being in contact with the wires and grid. The resulting face plate 10, with grid 14, wires 21, and photoluminescent material 24 thereon, may then be used in the completion of a color television tube, the remaining steps being well known in the art and forming no part of my present invention. As will be understood by those skilled in the art, the wires 21 may be selectively impressed with potentials of desired polarity, to control the electron scanning beam in the finished tube.

It is also to be understood that although I have illustrated and described the grid 14 as placed directly upon the face plate 10 which is normally used as the front lens of a television cathode ray tube, the grid may equally well be secured upon an auxiliary translucent or transparent plate that is carried within the finished television tube and suitably secured behind the face plate 10. Such auxiliary plate is not essential in my method of making a color television tube, as the grid 14 may be affixed by my method directly to the curved inner surface 13 of the face plate 10.

Other modifications will be apparent to those skilled in the art, and I do not desire to be limited to the precise embodiment disclosed and described herein, but desire to be afforded the full scope of the following claims.

I claim as my invention:

1. In a method of making a color television screen, the method employing a decalcomania including a binder, a plurality of sets of parallel translucent stripes of different-colored materials and a backing sheet therefor, including the steps of: affixing the decalcomania to a translucent plate; removing the backing sheet from the decalcomania so as to leave the balance of the decalcomania in its desired position on the plate; heating the plate with the decalcomania attached thereto to a temperature sufficient to drive substantially all volatiles from the decalcomania and to affix the colored stripes firmly to the plate; and coating at least a portion of the stripes with a photoluminescent material.

2. In a method of making a color television screen adapted to be joined to a glass or metal cone at a predetermined bonding temperature, the method employing a decalcomania including a binder, a plurality of sets of parallel translucent stripes of different-colored materials and a backing sheet therefor, including the steps of: affixing the decalcomania to a translucent plate; removing the backing sheet from the decalcomania so as to leave the balance of the decalcomania in its desired position on the plate; heating the plate with the decalcomania attached thereto to a temperature in excess of such bonding temperature to drive from the decalcomania substantially all materials which will vaporize at or below such bonding temperature; and coating at least a portion of the stripes with a photoluminescent material.

3. In a method of making a color television screen, the method employing a decalcomania including a binder, a plurality of sets of parallel translucent stripes of different-colored materials adherable to glass upon the application of a suitable high temperature and a backing sheet therefor, including the steps of: affixing the decalcomania to a translucent glass plate; removing the backing sheet from

the decalcomania so as to leave the balance of the decalcomania in its desired position on the plate; heating the plate with the decalcomania attached thereto to a temperature sufficient to drive substantially all volatiles from the decalcomania and to adhere the parallel colored stripes firmly to the plate; and coating at least a portion of the stripes with a photoluminescent material.

4. In a decalcomania, the combination of: a first layer consisting of a binder material; a second layer over said first layer and consisting of a plurality of sets of different-colored parallel stripes of a translucent material, each of the sets being of a different color and the stripes of one set alternating with those of another; a third layer over said second layer and consisting of a binder material; and a fourth layer over said third layer and consisting of a removable backing material.

5. In a decalcomania, the combination of: a first layer consisting of a binder material; a second layer over said first layer and consisting of a plurality of sets of different-colored parallel stripes of a translucent material, each of the sets being of a different color and the stripes of one set alternating with those of another; a third layer over said second layer and consisting of a binder material; electrically conductive wires on and parallel to at least some of said stripes, each wire being on a single stripe and having a width substantially less than that of its stripe; and a fourth layer over said third layer and said wires consisting of a removable backing material.

6. In a process of preparing a television tube screen plate, the process employing a decalcomania including a layer consisting of a plurality of sets of different colored parallel stripes of a translucent material and a binder therefore to be applied to the plate and a backing sheet for the layer of material, the process including the steps of: positioning the layer of material on the plate and removing the backing sheet from the layer of material, so as to leave the layer of material on the plate and temporarily adhering thereto; and heating the plate with the layer of material thereon to a temperature sufficient to drive substantially all volatiles from said layer of material and binder and to affix the layer of material firmly to the plate.

7. In a method of making a television screen, the method employing a face plate, a decalcomania including a layer consisting of a plurality of uniformly distributed sets of different colored spaced elements of a translucent material and a binder, and a backing sheet for said layer of material, including the steps of: applying the decalcomania to said plate and removing the backing sheet from the layer of material, so as to leave the layer of material temporarily adhering to said plate; and heating said plate and adhering material to a temperature sufficient to drive substantially all volatiles from said layer of material and binder and to affix said material firmly to said plate.

8. In a decalcomania for combination with a face plate to provide a television screen: a first layer consisting of a binder material; a second layer over said first layer and consisting of a plurality of uniformly distributed sets of different colored spaced elements of a translucent material; a third layer over said second layer and consisting of an adhesive material; and a fourth layer over said third layer and consisting of a removable backing material.

9. In a decalcomania for combination with a face plate to provide a television screen; a first layer consisting of a binder material; a second layer over said first layer and consisting of a plurality of uniformly distributed sets of different colored spaced elements of a translucent material, said second layer including electrically conductive grids on at least some of said sets; a third layer over said second layer and consisting of an adhesive material; and a fourth layer over said third layer and consisting of a removable backing material.

10. In a process of preparing a television tube screen plate, the process of employing a decalcomania including a layer consisting of a plurality of sets of different colored parallel stripes of a translucent material and electrical conductive wires positioned on at least some of said stripes and parallel thereto, a binder therefor to be applied to the plate, and a backing sheet for said layer, the process including the steps of: positioning said layer on the plate and removing the backing sheet from said layer so as to leave said layer on the plate and temporarily adhering thereto; and heating the plate with the layer of material thereon to a temperature sufficient to drive substantially all volatiles from said layer and binder and to affix said layer firmly to the plate.

11. In a decalcomania for combination with a face plate to provide a television screen: a first layer consisting of binder material; a second layer over said first layer and consisting of a translucent material having different color components arranged in a predetermined pattern in which said components are regularly interspersed, said second layer including electrically conductive grids on at least some of said translucent material, each of said grids being applied to said translucent material so as to be in contact only with material of a single color component; a third layer over said second layer and consisting of an adhesive material; and a fourth layer over said third layer and consisting of a removable backing material, whereby the relative positions of material of a certain color component and of an electrically conductive grid in contact therewith are predetermined and fixed when said decalcomania is affixed to a curved surface.

12. In a decalcomania, the combination of: a first layer consisting of a binding material; a second layer over said first layer and consisting of a plurality of sets of different elemental units of a translucent material, each of the sets being of a different color-producing substance and being arranged in a predetermined pattern in which said units are regularly interspersed; a third layer over said second layer and consisting of a binding material; and a fourth layer over said third layer and consisting of a removable backing material.

13. In a process of preparing a television screen plate, the process employing a decalcomania including a layer consisting of a plurality of sets of different colored elemental units of a translucent material and a binder therefor, to be applied to the plate, and a backing sheet for the layer of material, the process including the steps of: positioning the layer of material on the plate and removing the backing sheet from the layer of material, so as to leave the layer of material on the plate and temporarily adhering thereto; and heating the plate with the layer of material thereon to a temperature sufficient to drive substantially all volatiles from said layer of material and binder and to affix the layer of material firmly to the plate.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 23,672	Okolicsanyi	June 23, 1953
2,307,188	Bedford	Jan. 5, 1943
2,324,433	Scheetz	July 13, 1943
2,375,177	Reese	May 1, 1945
2,409,564	Heinecke et al.	Oct. 15, 1946
2,419,918	Scheetz	Apr. 29, 1947
2,446,440	Swedlund	Aug. 3, 1948
2,502,758	Short	Apr. 4, 1950
2,543,477	Sziklai	Feb. 27, 1951
2,577,368	Schultz et al.	Dec. 4, 1951
2,578,150	Rathke	Dec. 11, 1951
2,629,679	Rathke	Feb. 24, 1953
2,646,364	Porth	July 21, 1953